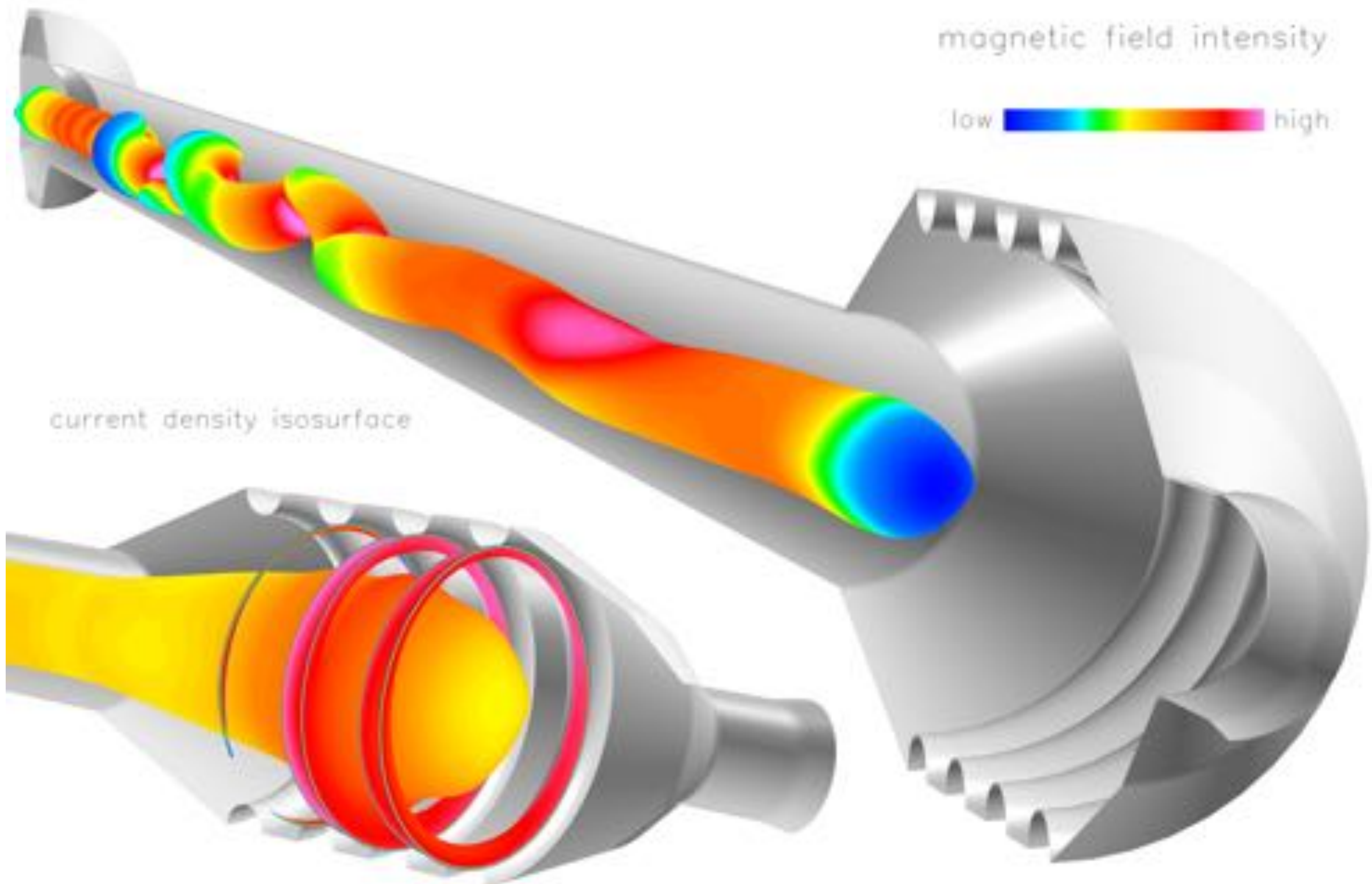
National Aeronautics and
Space Administration



In this simulation, electric arc attachment at the arc jet cathode chamber is mainly driven by upstream arc instabilities. An exterior ballast system balances the electric potential at each electrode, forcing an even distribution of the total electric current. An external magnetic field induces a Lorentz force that constantly changes the electric current attachment point, preventing the onset of electrode melt. These findings may inform arc jet facility maintenance schedules and design upgrades. *Jeremie B.E. Meurisse, Nagi N. Mansour, NASA/Ames*

Extreme Plasma Modeling for Planetary Entry and Space Exploration

Spaceflight missions to the Moon, Mars, and beyond require robust heat shields to protect spacecraft from extreme aerothermal heating during planetary entry. Replicating this hypersonic phenomenon on Earth is challenging, but crucial for validating thermal protection system (TPS) designs.

To enable TPS ground tests, arc jet wind tunnels reproduce the highly energetic plasma flows experienced during planetary entry. By running a continuous lightning bolt between two electrode chambers, energy is pumped into the test gas. Computational fluid dynamics modeling helps us understand this energetic process and provides insight into the complex plasma behavior. This understanding enables optimization of arc jet operational capabilities.

Sander J. Visser, Nagi N. Mansour, NASA Ames Research Center

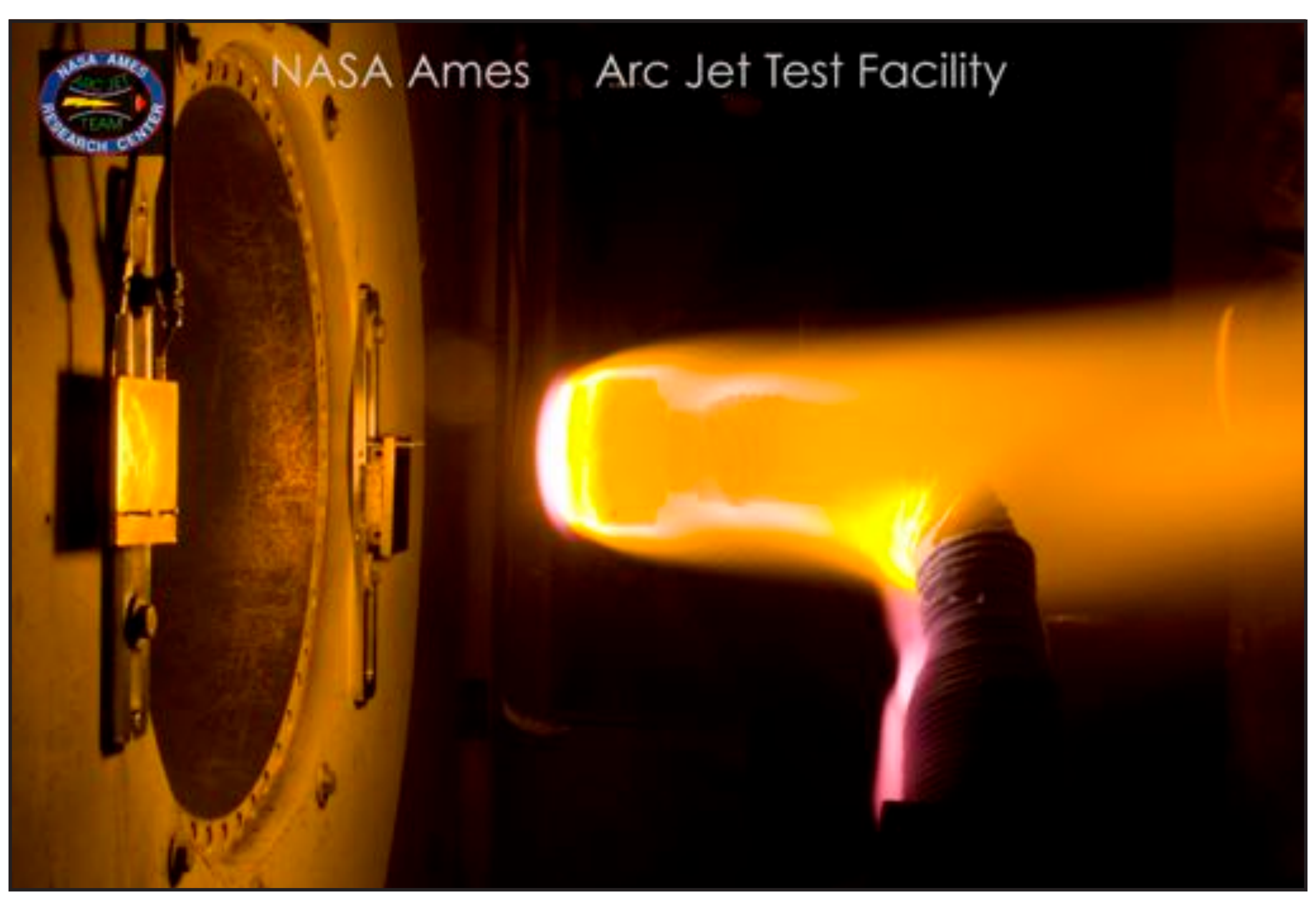


Photo of an arc jet in operation at the NASA Ames Arc Jet Complex. A gas mixture is injected to replicate a planetary atmosphere; instabilities in the arc arise due to interactions with this cold flow. A large electric potential difference between two electrode chambers induces an electric arc that energizes the flow to extreme temperatures via Joule heating.
Cesar Acosta, NASA/Ames